

Claims:

What is claimed is:

1. A quantum well infrared photodetector comprising:
 5 a plurality of doped quantum well layers forming a multi-quantum well structure for providing high absorption at temperatures other than low temperatures; and, contact layers for receiving current from the plurality of quantum well layers.
2. A quantum well infrared photodetector according to claim 1 wherein the multi-
 10 quantum well structure is for providing high absorption at temperatures near room temperature.
3. A quantum well infrared photodetector according to claim 2 wherein the plurality of doped quantum well layers includes more than 10 quantum well layers.
- 15 4. A quantum well infrared photodetector according to claim 3 wherein the dopant concentration is selected to be sufficiently large for high absorption during near room temperature operation.
- 20 5. A quantum well infrared photodetector according to claim 4 wherein the doping density (N_d) is given by $N_d = (m/\pi\hbar^2)(2k_B T)$, where m is the effective mass, \hbar is the Planck constant, k_B is the Boltzmann constant, and T is the desired operating in degrees K.
- 25 6. A quantum well infrared photodetector according to claim 5 wherein the well material is GaAs, the barrier material is Al GaAs, and the operating temperature is room temperature and N_d is in the range of $1 - 2 \times 10^{12} \text{ cm}^{-2}$.
- 30 7. A quantum well infrared photodetector according to claim 6 wherein the contact layers are formed of GaAs doped with Si to a concentration of 1×10^{17} to $5 \times 10^{18} \text{ cm}^{-3}$.

8. A quantum well infrared photodetector comprising:
a plurality of doped quantum well layers forming a multi-quantum well structure
for providing high absorption and dark current at temperatures other than low
5 temperatures; and,
contact layers for receiving current from the plurality of quantum well layers.

9. A quantum well infrared photodetector comprising:
a plurality of quantum well layers formed of a first semiconductor material and
10 doped forming a multi-quantum well structure for providing high absorption at
temperatures other than low temperatures and substantial dark current;
barriers between the quantum well layers formed of a second semiconductor
material; and,
contact layers comprising a third doped semiconductor.

10. A quantum well infrared photodetector according to claim 9 wherein temperatures
other than low temperatures include temperatures at or near room temperature.

11. A quantum well infrared photodetector according to claim 10 wherein the first
20 semiconductor material is GaAs.

12. A quantum well infrared photodetector according to claim 11 wherein the dopant
for doping the first semiconductor material is Si.

25 13. A quantum well infrared photodetector according to claim 12 wherein dopant
concentration of the Si is approximately $1 - 2 \times 10^{12} \text{ cm}^{-2}$.

14. A quantum well infrared photodetector according to claim 13 wherein second
semiconductor material is Al GaAs.

30 15. A quantum well infrared photodetector according to claim 14 wherein fraction of
Al is from 10%-50%.

16. A quantum well infrared photodetector according to claim 15 wherein the third doped semiconductor material is GaAs doped with Si.

5 17. A quantum well infrared photodetector according to claim 16 wherein the third doped semiconductor material is doped with Si to a concentration of $1\text{E}17$ to $5\text{E}18\text{ cm}^{-3}$.

18. A quantum well infrared photodetector according to claim 17 wherein the third doped semiconductor material of a thickness within a range of $0.1\text{-}2\text{ }\mu\text{m}$.

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19. A quantum well infrared photodetector according to claim 8 wherein the plurality of doped quantum well layers is designed for operation at frequencies above 1 GHz .

20. A quantum well infrared photodetector according to claim 19 wherein the
15 plurality of doped quantum well layers is designed for operation at frequencies above 30 GHz .

21. A method of detecting infrared radiation comprising the steps of:
detecting infrared radiation with a quantum well device absent cryogenic cooling; and,
20 determining an intensity of the detected infrared radiation.

22. A method of detecting infrared radiation according to claim 19 wherein the step
of determining comprises the step of:
filtering the dark current component of the detected signal to determine an
25 intensity of the detected infrared radiation.

23. A method of detecting infrared radiation according to claim 19 wherein the step
of detecting is performed at or near room temperature